(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: 0 486 966 B1

(12) # EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: 05.07.95 Bulletin 95/27

(51) Int. Cl.[6]: H02N 13/00, H01L 21/00

(21) Application number: 91119528.7

(22) Date of filing: 15.11.91

(54) **Electrostatic chuck.**

(30) Priority: 17.11.90 JP 312479/90

(43) Date of publication of application: 27.05.92 Bulletin 92/22

(45) Publication of the grant of the patent: 05.07.95 Bulletin 95/27

(84) Designated Contracting States: DE FR GB IT NL

(56) References cited:
EP-A- 0 171 011
WO-A-79/00510
US-A- 4 724 510
PATENT ABSTRACTS OF JAPAN vol. 15, no. 383 (E-111) 27 September 1991 & JP-A-3 152 953
PATENT ABSTRACTS OF JAPAN vol. 15, no. 94 (E-104) 6 March 1991 & JP-A-2 304 946
PATENT ABSTRACTS OF JAPAN vol. 8, no. 115 (E-247) 29 May 1984 & JP-A-59 028 354
PATENT ABSTRACTS OF JAPAN vol. 14, no. 170 (E-91) 30 March 1990 & JP-A-2 027 748
PATENT ABSTRACTS OF JAPAN vol. 8, no. 268 (E-283) 7 December 1984 & JP-A-59 139 641

(73) Proprietor: TOKYO ELECTRON LIMITED
2-3-1, Nishi-Shinjuku
Shinjuku-ku, Tokyo (JP)
(84) DE FR GB IT NL
Proprietor: KABUSHIKI KAISHA TOSHIBA
72, Horikawa-cho
Saiwai-ku
Kawasaki-shi Kanagawa-ken 210 (JP)
(84) DE FR GB

(72) Inventor: Nozawa, Toshihisa
7-1-36, Kasumigaoka,
Tarumi-ku
Kobe-shi, Hyogo-ken (JP)
Inventor: Arami, Junichi
4-15-19, Nishiochiai
Shinjuku-ku, Tokyo (JP)
Inventor: Kubota, Shinji
2-20-3-1202, Sagamioono
Sagamihara-shi, Kanagawa-ken (JP)
Inventor: Hasegawa, Isahiro
1-16-3, Kotsubo
Zushi-shi, Kanagawa-ken (JP)
Inventor: Okumura, Katsuya
1-4-6-609, Utsukushigaoka
Midori-ku, Yokohama-shi (JP)

(74) Representative: Lehn, Werner, Dipl.-Ing. et al
Hoffmann, Eitle & Partner,
Patentanwälte,
Postfach 81 04 20
D-81904 München (DE)

EP 0 486 966 B1

Jouve, 18, rue Saint-Denis, 75001 PARIS

Description

This invention relates to an electrostatic chuck according to the preamble of claim 1 known from JP-A-3 152 953 for use in a treatment apparatus such as a plasma etching apparatus to electrostatically hold an object such as a wafer by a coulombic force.

In a plasma etching apparatus, for example, an electrostatic chuck is used to electrostatically hold an object such as a wafer.

The electrostatic chuck has an insulating layer and an electrode as basic constituents. An object to be chucked, for example a wafer is to be placed on the insulating layer. That is, the wafer is aligned with the electrode, with the insulation layer interposed therebetween. At this time, a voltage is applied between the wafer and electrode, thereby causing positive charge on one side and negative charge on the other side. Accordingly, a coulombic force is exerted therebetween, and the wafer is attracted onto the chuck.

For example, an electrostatic chuck is known which is provided with an electrostatic holding sheet having a conductive sheet made of copper and interposed between two insulation polyimide sheets formed on a base member. In this chuck, an object such as a wafer is placed on the holding sheet, and is electrostatically held by the holding sheet when a voltage is applied to the holding sheet by a high voltage power source via a feeding sheet formed integral with the holding sheet.

This electrostatic sheet, however, will easily be broken since the polyimide insulation layer is formed thin so as to obtain a required coulombic force, and since polyimide itself has a low strength. Further, if the electric charge of the polyimide insulation sheet is removed by using plasma after the wafer is unloaded, the sheet will be damaged by the plasma. It is a great disadvantage of the above-described electrostatic chuck that the life of the polyimide used as an insulating layer is short.

Moreover, the temperature of a wafer is generally controlled via the base of the chuck. That surface of the wafer which is brought into contact with the insulation sheet is small since the wafer surface is uneven microscopically, and the thermal conductivity of polyimide is low. Thus, the thermal conductivity of the chuck is low, which makes it difficult to perform appropriate temperature control of the wafer. Therefore, in the electrostatic chuck, a clearance between the wafer and insulation sheet is filled with a gas under a predetermined pressure to obtain a good thermal conductivity. To obtain a sufficient thermal conductivity without using such a gas, the holding force of the holding sheet must be enhanced. However, it is difficult to do so in the case of the above electrostatic chuck employing insulating sheet made of polyimide.

To remove these disadvantages, such an electrostatic chuck has been made which employs an insulating sheet made of a ceramic material such as an alumina sintered body. This chuck is made by using a conventional method for producing a multi-layered ceramic substrate. Specifically, for example, an alumina substrate is formed on a base, and an alumina layer is formed on the substrate with a conductive tungsten pattern interposed therebetween. The electrostatic sheet thus constructed has a ceramic insulator, so that the chuck has a high durability and a high strength against plasma damage, i.e., it is not easily broken. In addition, the wafer-holding force of the chuck can be increased.

However, if electrostatic chucks are produced by mainly using a ceramic sintered body, the yield of the chucks will be low, and the cost thereof will be extremely high, due to distortion and the like caused by sintering.

US-A-4 724 510 discloses an electrostatic chuck comprising a base, a first insulating layer of SiO_2, a conductive layer on said first insulating layer, and a second insulating layer of SiO_2, polyimide, or glass.

It is an object of the invention to provide a cheap electrostatic chuck which is not broken with ease.

It is another object of the invention to provide a cheap electrostatic chuck having a high holding force.

This object is achieved by the characterizing features of claim 1.

Preferred embodiments are listed in the dependent claims

In the invention constructed as above, since the second insulating layer interposed between the object and electrode is made of a ceramic dielectric material, it has a good durability and a higher resistance against plasma shock than the conventional insulating layer made of polyimide. Thus, the second insulating layer is not easily broken though it is thin. Moreover, the simple process in which the second insulating layer made of the inorganic dielectric material is formed on the first insulation layer with the adhesive layer interposed therebetween, enables electrostatic chucks to be produced with a high yield and at low cost. Further, the second insulation layer formed of the ceramic dielectric material enables the electrostatic chuck to have a great object-holding force, thereby facilitating the temperature control of the object.

This invention can be more fully understood from the following detailed description when taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a schematic sectional view, showing a magnetron plasma etching apparatus employing an electrostatic chuck according to an embodiment of the present invention;

Fig. 2 is a sectional view, showing the electrostatic chuck of Fig. 1;

Fig. 3 is a perspective view, showing a base

member employed in the electrostatic chuck of Fig. 1;

Figs. 4 to 7 are enlarged sectional views, showing part of each of electrostatic chucks according to other embodiments of the invention;

Fig. 8 is a bottom view, showing an electrostatic holding sheet; and

Fig. 9 is a plan view, showing a feeding sheet before it is bent.

Electrostatic chucks according to the embodiments of the present invention, which are for use in a plasma etching apparatus, will be explained in detail with reference to the accompanying drawings.

Fig. 1 is a schematic view of a plasma etching apparatus employing an electrostatic chuck according to an embodiment of the present invention. This device has a vacuum chamber 10, an electrostatic chuck 20 provided in the chamber 10 for electrostatically holding a wafer 1, a magnet section 30 provided above the chamber 10, and a RF power source 4.

The vacuum chamber 10 comprises an upper chamber structure 11 and a lower chamber structure 12. An exhaust port 13 is formed in a lower portion of the side wall of the upper chamber structure 11, through which gases in the chamber 10 are exhausted by an exhaust pump (not shown) connected to the port. The vacuum chamber 10 is designed such that pressure therein can be reduced up to approx. 10^{-6} Torr. A plurality of gas inlets 14 for introducing etching gases in the chamber 10 are formed in the upper portion of the upper chamber structure 12. A gas supply pipe 14a, through which an etching gas is supplied from a gas supply source (not shown) to the chamber 10, is connected to the gas inlets 14.

The electrostatic chuck 20 has a base member 21 and an elastic electrostatic holding sheet 22 having a laminated structure, and is formed on a support member 28. The electrostatic holding sheet 22 is connected to a high voltage direct current power source 24 via a power supply sheet 23. The electrostatic chuck 20 will be explained in detail latter.

A ceramic member 15 is interposed between the support member 28 and lower chamber structure 12, thereby electrically isolating them from each other. A fluid passage 29 is formed in the support member 28 for circulating a cooling fluid. The temperature of the wafer 1 is controlled by circulating a fluid, having a predetermined temperature, through the passage 29.

The base member 21 and support member 28 are made of e.g. aluminum.

A hole 6 extends through the chamber 10, ceramic member 15, support member 28, and electrostatic chuck 20. A heat-transfer gas such as He or O_2 is supplied from a gas supply source 5 through the hole 6. The gas is supplied between the electrostatic chuck 20 and wafer, thereby enhancing the thermal conductivity between the chuck 20 and wafer 1, and hence controlling the temperature of the wafer 1 accurately.

The high frequency power supply 4 is connected to the base member 21 of the electrostatic chuck 20, and the upper chamber structure 11 is grounded. Accordingly, when a high frequency power is supplied, the upper wall of the upper chamber structure 11 serves as upper electrode, while the base member 21 serves as lower electrode, thereby causing plasma therebetween.

The magnet section 30 has a function of applying a magnetic field between the electrodes, and comprises a support member 31 extending in the horizontal direction, a permanent magnet 32 supported by the support member 31, and a motor 33 for rotating them in the direction indicated by the arrow.

In the magnetron plasma etching device constructed as above, an etching gas is guided into the chamber 10, and etching is performed in a state where a high frequency power is applied between the upper and lower electrodes, and also a magnetic field perpendicular to the electric field caused between the electrodes is applied therebetween by rotating the permanent magnet 32. At this time, electrons caused between the electrodes perform cyclone movement. Since collision between the electrons and gas molecules accelerates electrolytic dissociation of the molecules, a high etching speed of 1 µm/min can be obtained even under a low pressure of 10^{-2} to 10^{-3} Torr. Thus, the time required for treating each wafer is short, and the reliability of etching is enhanced. Further, the average energy of ions is low, which prevents the wafer from being greatly damaged.

The electrostatic chuck 20 for electrostatically holding wafers will be explained in detail. Fig. 2 is a sectional view, showing the chuck 20. As is mentioned above, the chuck 20 has the base member 21 and electrostatic holding sheet 22, which is connected to the power supply 24 via the feeding sheet 23.

As is shown in Fig. 3, the base member 21 comprises a cylindrical body with a stepped portion. The stepped portion has an upper surface 21a provided with a depression 61 and a slit 62 for receiving the power supply sheet. The slit 62 extends to the bottom of the base member 21.

The electrostatic holding sheet 22 is circular to correspond to the shape of the upper surface 21a of the base member 21, and for example, as is shown Fig. 4, comprises a first insulating layer 41 provided on the side of the base member, a second insulating layer 42 provided on the wafer side and formed of an ceramic dielectric material, an organic adhesive layer 43 bonding the layers 41 and 42, and a conductive sheet 44 extending in the adhesive layer 43. The first insulating layer 41 is adhered to the base member 21 by means of an organic adhesive layer 46.

The first insulating layer 41 is made of an organic material such as polyimide, and the second insulating layer 42 is formed of an inorganic dielectric material. This dielectric material may be made of a ceramic ma-

terial such as $A\ell N$, $A\ell_2O_3$, SiO_2, $TiBaO_3$, or Si_3N_4. The insulating layer 42 may be a crystal state or a glass state, and may be formed a sintered body or a thin film obtained by a thin-film forming technique such as CVD (chemical vapour deposition). The organic adhesive layers 43 and 26 are each made of an organic material having an effective adhering function, such as a thermosetting resin. Further, the conductive sheet 44 is made of a metal having a good conductivity, such as copper.

Though in the embodiment of Fig. 4, the conductive sheet 44 is inserted in the adhesive layer 43, a conductive thin film 45 having a thickness of e.g. 1 to 5 μm may be formed, instead of the insertion of the sheet 44, on the lower surface of the second insulating layer 42, as is shown in Fig. 5. Further, as is shown in Fig. 6, the conductive thin film 45 may be formed on the upper surface of the first insulating layer 41.

Moreover, the structure shown in Fig. 7 may be employed. In this embodiment, the first insulating layer 41 comprises a lower layer 41a and an upper layer 41b, and the conductive sheet 44 is interposed between them. The structure is advantageous in that high insulation characteristic can be maintained between the conductive sheet 44 and wafer 1 even at a high temperature, particularly in a case where the ceramic dielectric second insulating layer 42 is made of $A\ell N$. That is, though the insulation characteristic of $A\ell N$ is reduced as the temperature is reduced, the conductive sheet 44 is kept insulated since it is inserted in the first insulating layer 41 made of such an organic material as polyimide. Thus, leakage of current at a high temperature can be prevented in a reliable manner.

As is shown in Fig. 8, a contact 51 for electrically connecting the electrostatic holding sheet 22 to the feeding sheet 23 is provided on the reverse side of the sheet 22. The contact 51 is formed by cutting out part of the first insulating layer 41, thereby exposing the conductive sheet 44 therethrough. The sheet 22 is provided with a plurality of gas inlets 56 extending through the sheet in the thickness direction thereof. A heat transfer gas such as He or O_2 is guided between the electrostatic sheet 22 and wafer 1 through the gas inlets 56 to enhance the heat conductivity therebetween.

The feeding sheet 23 has two polyimide sheets 47 serving as insulation members and a conductive sheet 48 interposed therebetween. As is shown in Fig. 9, the sheet 23 has a narrow portion 54 having a contact 52 formed therein, and a wide portion 55 having a contact 53 formed therein. In a state where the sheet 23 is mounted on the chuck, as is shown in Fig. 2, the sheet 23 comprises a vertical portion 23a, and an upper portion 23b and a lower portion 23c both extending parallel with the upper surface of the base member 21. The upper portion 23b corresponds to the narrow portion 54, while the vertical portion 23a and lower portion 23c corresponds to the wide portion 55. The contacts 51 and 52 are connected to each other, and the contact 53 is connected to a line leading to the power supply 24. Further, that portion of the sheet 23 which is in the vicinity of the contact 53 is exposed to the atmosphere, so that the contact 53 and the portion near it are sealed by an O-ring so as to perform power supply in the atmosphere in which discharge phenomenon is not found.

The upper portion 23b (corresponding to the narrow portion 54) of the feeding sheet 23 is accommodated in the depression 61 of the base member 21 such that it is leveled with the surface 21a of the base member 21. The vertical portion 23a (corresponding to the wide portion 55) is accommodated in the slit 62. Accordingly, the sizes of the depression 61 and slit 62 are determined in accordance with the upper portion 23b and vertical portion 23a, respectively.

To mount the feeding sheet 23 as shown in Fig. 2, the wide portion 55 is inserted into the slit 62, then the narrow portion 54 is bent at a right angle to the wide portion 55 to fit the portion 54 in the depression 61, and that portion of the wide portion 55 which extends out of the slit 62 is bent at a right angle thereto to extend along the lower surface of the base member 21.

It is preferable to use, as the insulation material of the feeding sheet 23, a material having substantially the same thermal coefficient as the first insulation layer 41 of the electrostatic holding sheet 22.

Electrostatic holding manner of the chuck 20 constructed as above will now be explained.

The electrostatic chuck shown in Fig. 2 is a monopole type. The wafer 1 is placed on the chuck, and a high voltage is applied between the wafer 1 and conductive sheet 44, while plasma is discharged. Thus, the wafer 1 is charged with positive electricity, and the conductive sheet 44 is charged with negative electricity. The wafer 1 is attracted onto the chuck 20 by means of a coulombic force exerted between the wafer 1 and the chuck 20. More detailed, the wafer 1 is grounded by means of the ground electrode and plasma, then a high voltage of e.g. 2kv is applied to the conductive sheet 44, and a coulombic force is exerted between the wafer 1 and sheet 44, whereby the wafer 1 is electrostatically held by the holding sheet 22. In this state, plasma etching is performed.

Since the second insulating layer 42 provided between the wafer 1 and conductive sheet 44 is made of an ceramic dielectric material, it has a good durability and a higher resistance against plasma shock than the conventional insulation layer made of polyimide. Thus, the second insulating layer 42 is not easily broken though it is thin. Moreover, the simple process in which the second insulating layer 42 made of the ceramic dielectric is formed on the first insulating layer 41 with the adhesive layer 43 interposed therebetween, enables electrostatic chucks to be pro-

duced with a high yield and at low cost. Further, the second insulating layer 42 formed of the ceramic dielectric material enables the electrostatic chuck to have a great object-holding force, thereby facilitating the temperature control of the object.

Then, experimental results obtained by using an electrostatic holding sheet constructed as shown in Fig. 4 will be explained. In this sheet, the second insulating layer 42 is formed of an AℓN sintered body, the first insulating layer 41 is made of polyimide, and the adhesive layer 43 is made of a thermosetting resin.

First, the wafer-holding force of the sheet was tested. Further, a reference electrostatic holding sheet was prepared, which employed a second insulating layer made of polyimide in place of AℓN, and was tested in a manner similar to the above. Measurement results indicate that the holding force of the reference electrostatic chuck is to 40 Torr at maximum, while that of the chuck of the example is 60 Torr or more.

Then, the temperature control property of water 1 (5 inch (12.7 cm) wafer) was tested. A liquid which is hard to be freezed such as anitifreezing fluid as a coolant was circulated through the fluid passage 29 shown in Fig. 1, and O_2 gas serving as thermal transfer gas was supplied between the wafer and sheet. The pressure of the thermal transfer gas was varied, thereby varying the temperature of the wafer. The temperature of a central portion of the wafer and the temperature of that peripheral portion thereof which was spaced 50 mm from the central portion were measured. Also in this case, a test similar to the above was carried out with respect to the reference electrostatic holding sheet.
Measurement results show that the electrostatic chuck of the example has a cooling capacity higher than the reference one and being operable substantially independent of the O_2 gas pressure, and that the cooling capacity of the reference chuck depends upon the O_2 gas pressure, i.e., the temperature of the wafer abruptly increases when the O_2 gas is lower than a predetermined value.

It is considered that the above-described advantages of the invention were obtained by virtue of the increased wafer-holding force of the electrostatic holding sheet 22, i.e., the increased thermal conductivity between the wafer and sheet, owing to the second insulating layer 42 made of AℓN. This being so, a predetermined thermal conductivity can be obtained in a reliable manner without supply of O_2 gas. Thus, wafer-temperature control can be performed by using a second insulating layer made of AℓN without using a thermal transfer gas.

Further, the temperature of the wafer 1 was measured when the RF power for generating plasma increased. Measurement results indicate that though the temperature of the wafer increased as the RF power increased, the rate of an increase in the temperature of a wafer treated using the electrostatic chuck of the example incorporating an AℓN sheet is lower than that of an increase in the temperature of a wafer in the reference electrostatic chuck. This is owing to the good heat conductivity of AℓN contained in the second insulating layer. It can be understood from the above that the electrostatic chuck of the example is effective, in particular, in an apparatus using plasma.

In addition, since AℓN is not easily charged with electricity as compared with polyimide, the insulation layer can be easily discharged by means of plasma ions after the wafer is removed from the chuck, and has a high shock-resistance against the plasma ions. Further, AℓN itself has a higher durability than polyimide.
Therefore, the electrostatic chuck employing the second insulation layer 42 made of AℓN has a life longer than the conventional electrostatic chuck.

The invention is not limited to the above-described embodiments, but for example, though the embodiment is applied to a magnetron plasma etching apparatus, it may also be applied to plasma etching apparatus of an inter-electrode discharge type, a micro-wave radiation type, etc. Moreover, the invention is applicable to devices other than plasma etching apparatus, such as an ECR (electron cyclotron resonance) etcher, a plasma CVD device, a wafer prober, etc., if they need to electrostatically hold a plate-like object such as a wafer. Furthermore, the invention is not limited to an electrostatic chuck capable of controlling the temperature of an object, and is also applicable to an electrostatic chuck of a type other than a mono-pole type.

Claims

1. An electrostatic chuck for holding an object using a coulombic force, comprising:
   a) a base member (21);
   b) a first insulating layer (41) made of an organic material formed on said base member (21);
   c) a second insulating layer (42) made of an inorganic material; and
   d) an electrode (44, 45);
   wherein the object (1) is placed on the second insulating layer (42), and a voltage is applied between the object (1) and the electrode (44, 45), thereby creating static electricity and hence a coulombic force for holding the object (1) on the second insulating layer (42);
   characterized by
   e) an adhesive layer (43) made of an organic material and adhering the first insulating layer (41) to the second insulating layer (42);

f) said electrode (44, 45) being insulatively provided in the adhesive layer (43) between the first and second insulating layers (41, 42) or in said first insulating layer (41); and
g) said inorganic material is a ceramic material.

2. The electrostatic chuck according to claim 1, characterized in that the second insulating layer (42) is formed of a sintered body.

3. The electrostatic chuck according to claim 2, characterized in that the second insulating layer (42) is made of AℓN.

4. The electrostatic chuck according to claim 1, characterized in that the second insulating layer (42) is a thin film.

5. The electrostatic chuck according to claim 1, characterized in that the second insulating layer (42) has a crystal body or a glass body.

6. The electrostatic chuck according to claim 1, characterized in that the first insulating layer (41) is made of polyimide.

7. The electrostatic chuck according to claim 1, characterized in that the adhesive layer (43) is made of a thermosetting resin.

8. The electrostatic chuck according to claim 1, characterized in that the electrode (44) is provided in the adhesive layer (43).

9. The electrostatic chuck according to claim 1, characterized in that the electrode (45) is formed on the lower surface of the second insulating layer (42).

10. The electrostatic chuck according to claim 1, characterized in that the electrode (45) is formed on the upper surface of the first insulating layer (41).

11. The electrostatic chuck according to claim 1, characterized by further comprising:
power supply means (24) for applying a voltage between the electrode (44, 45) and the object (1); and
feeding means (23) for feeding power from the power supply means (24) to the electrode (44, 45).

12. The electrostatic chuck according to claim 1, characterized in that the first and second insulating layer (41, 42) and the adhesive layer (43) have a gas inlet (6) extending from the upper surface to the lower surface thereof, and a gas for transferring heat is guided between the object (1) and the electrostatic holding sheet (22) through the gas inlet (6).

Patentansprüche

1. Elektrostatischer Chuck zum Halten eines Objektes unter Benutzung einer Coulomb-Kraft, welcher umfaßt:
a) ein Basiselement (21);
b) eine erste Isolationsschicht (41), hergestellt aus einem organischen Material, das auf dem Basiselement (21) gebildet ist;
c) eine zweite Isolationsschicht (42), hergestellt aus einem anorganischen Material; und
d) eine Elektrode (44, 45);
wobei das Objekt (1) auf der zweiten Isolationsschicht (42) plaziert ist und eine Spannung angelegt ist zwischen dem Objekt (1) und der Elektrode (44, 45), um dadurch eine statische Elektrizität zu schaffen und damit eine Coulomb-Kraft zum Halten des Objektes (1) auf der zweiten Isolationsschicht (42);
gekennzeichnet durch
e) eine adhäsive Schicht (43), hergestellt aus einem organischen Material, zum Anhaften der ersten Isolationsschicht (41) an die zweite Isolationsschicht (42);
f) die Elektrode (44, 45) in isolierender Art und Weise vorgesehen in der adhäsiven Schicht (43) zwischen der ersten und der zweiten Isolationsschicht (41, 42) oder in der ersten Isolationsschicht (41); und
g) das organische Material als ein keramisches Material.

2. Elektrostatischer Chuck nach Anspruch 1, dadurch gekennzeichnet, daß die zweite Isolationsschicht (42) aus einem gesinterten Körper hergstellt ist.

3. Elektrostatischer Chuck nach Anspruch 2, dadurch gekennzeichnet, daß die zweite Isolationsschicht (42) aus AlN hergestellt ist.

4. Elektrostatischer Chuck nach Anspruch 1, dadurch gekennzeichnet, daß die zweite Isolationsschicht (42) ein dünner Film ist.

5. Elektrostatischer Chuck nach Anspruch 1, dadurch gekennzeichnet, daß die zweite Schicht (42) einen kristallinen Körper oder einen Glaskörper hat.

6. Elektrostatischer Chuck nach Anspruch 1, dadurch gekennzeichnet, daß die erste Isolations-

schicht (41) aus Polyimid hergestellt ist.

7. Elektrostatischer Chuck nach Anspruch 1, dadurch gekennzeichnet, daß die adhäsive Schicht (43) aus einem Thermosetzharz hergestellt ist.

8. Elektrostatischer Chuck nach Anspruch 1, dadurch gekennzeichnet, daß die Elektrode (41) in der adhäsiven Schicht (43) vorgesehen ist.

9. Elektrostatischer Chuck nach Anspruch 1, dadurch gekennzeichnet, daß die Elektrode (45) auf der unteren Oberfläche der zweiten Isolationsschicht (42) ausgebildet ist.

10. elektrostatischer Chuck nach Anspruch 1, dadurch gekennzeichnet, daß die Elektrode (45) auf der oberen Oberfläche der ersten Isolationsschicht (41) ausgebildet ist.

11. Elektrostatischer Chuck nach Anspruch 1, gekennzeichnet durch:
eine Leistungsversorgungseinrichtung (24) zum Anlegen einer Spannung zwischen der Elektrode (44, 45) und dem Objekt (1); und
eine Einspeisungseinrichtung (23) zum Einspeisen von Leistung von der Leistungsversorgungseinrichtung (24) an die Elektrode (44, 45).

12. Elektrostatischer Chuck nach Anspruch 1, dadurch gekennzeichnet, daß die erste und die zweite Isolationsschicht (41, 42) und die adhäsive Schicht (43) einen Gaseinlaß (6) haben, der sich von der oberen Oberfläche zu der unteren Oberfläche davon erstreckt, und ein Gas zum Transferieren von Wärme zwischen das Objekt (1) und die elektrostatische Halteschicht (22) durch den Gaseinlaß (6) geleitet wird.

Revendications

1. Mandrin électrostatique pour maintenir un objet en utilisant une force de Coulomb, comprenant :
a) un élément de base (21) ;
b) une première couche isolante (41) réalisée en un matériau organique formée sur ledit élément de base (21) ;
c) une seconde couche isolante (42) réalisée en un matériau inorganique ; et
d) une électrode (44, 45),
dans lequel l'objet (1) est placé sur la seconde couche isolante (42) et une tension est appliquée entre l'objet (1) et l'électrode (44, 45), ce qui crée de l'électricité statique et par conséquent une force de Coulomb pour maintenir l'objet (1) sur la seconde couche isolante (42),
caractérisé par :
e) une couche adhésive (43) réalisée en un matériau organique et faisant adhérer la première couche isolante (41) sur la seconde couche isolante (42) ;
f) ladite électrode (44, 45) étant agencée de façon isolante dans la couche adhésive (43) entre les première et seconde couches isolantes (41, 42) ou dans ladite première couche isolante (41) ; et
g) ledit matériau inorganique est un matériau de céramique.

2. Mandrin électrostatique selon la revendication 1, caractérisé en ce que la seconde couche isolante (42) est formée par un corps fritté.

3. Mandrin électrostatique selon la revendication 2, caractérisé en ce que la seconde couche isolante (42) est réalisée en AlN.

4. Mandrin électrostatique selon la revendication 1, caractérisé en ce que la seconde couche isolante (42) est un film mince.

5. Mandrin électrostatique selon la revendication 1, caractérisé en ce que la seconde couche isolante (42) comporte un corps cristallin ou un corps vitreux.

6. Mandrin électrostatique selon la revendication 1, caractérisé en ce que la première couche isolante (41) est réalisée en polyimide.

7. Mandrin électrostatique selon la revendication 1, caractérisé en ce que la couche adhésive (43) est réalisée en résine thermodurcissable.

8. Mandrin électrostatique selon la revendication 1, caractérisé en ce que l'électrode (44) est prévue dans la couche adhésive (43).

9. Mandrin électrostatique selon la revendication 1, caractérisé en ce que l'électrode (45) est formée sur la surface inférieure de la seconde couche isolante (42).

10. Mandrin électrostatique selon la revendication 1, caractérisé en ce que l'électrode (45) est formée sur la surface supérieure de la première couche isolante (41).

11. Mandrin électrostatique selon la revendication 1, caractérisé en ce qu'il comprend en outre :
un moyen d'alimentation (24) pour appliquer une tension entre l'électrode (44, 45) et l'objet (1) ; et
un moyen d'application (23) pour appli-

quer de l'énergie provenant du moyen d'alimentation (24) sur l'électrode (44, 45).

12. Mandrin électrostatique selon la revendication 1, caractérisé en ce que les première et seconde couches isolantes (41, 42) et la couche adhésive (43) comportent une entrée de gaz (6) s'étendant depuis sa surface supérieure jusqu'à sa surface inférieure et un gaz pour transférer de la chaleur est guidé entre l'objet (1) et la feuille de maintien électrostatique (22) au travers de l'entrée de gaz (6).

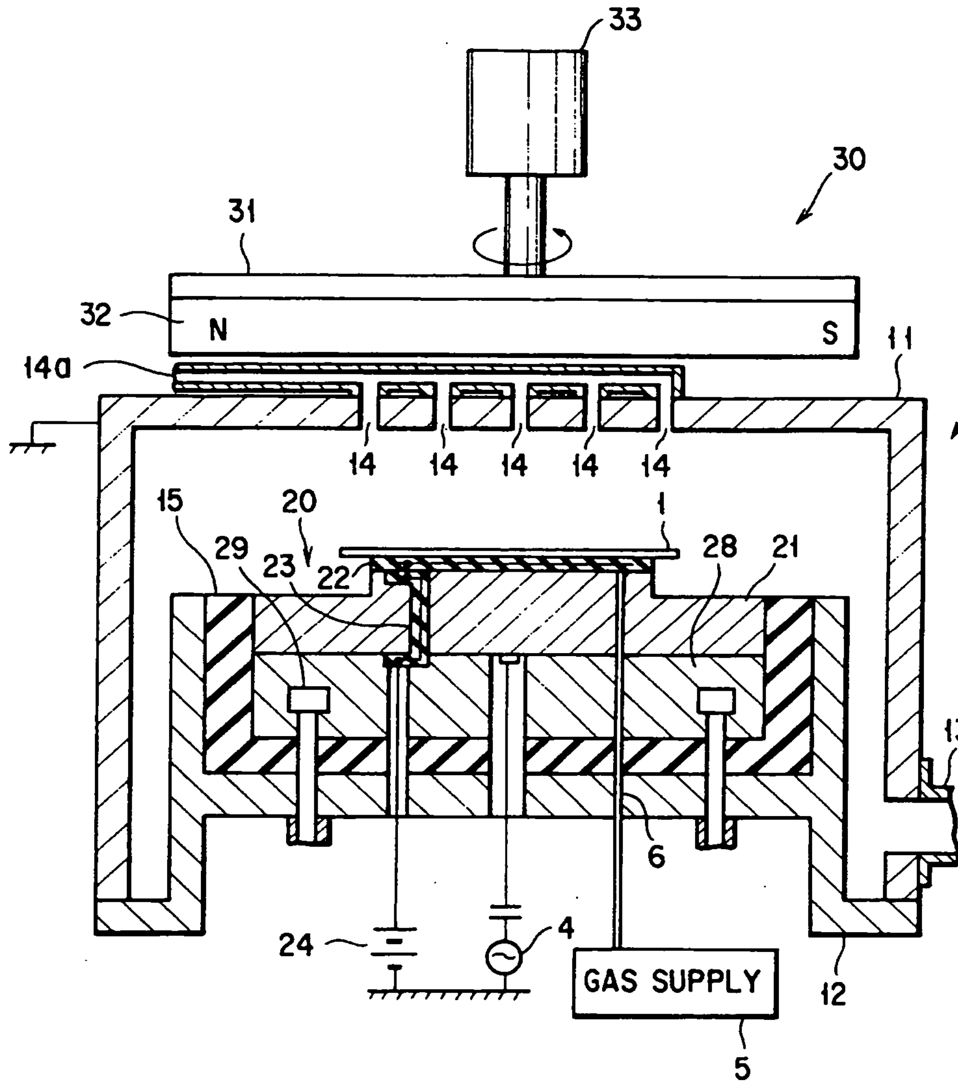
33
30
31
32
N
S
14a
11
10
14
14
14
14
14
15
20
1
29
23
22
28
21
13
6
24
4
GAS SUPPLY
12
5

FIG. 1

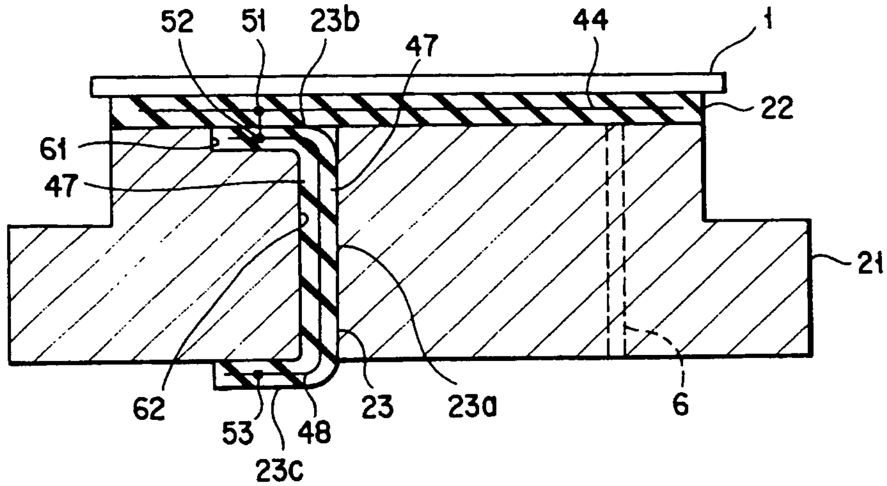

FIG. 2

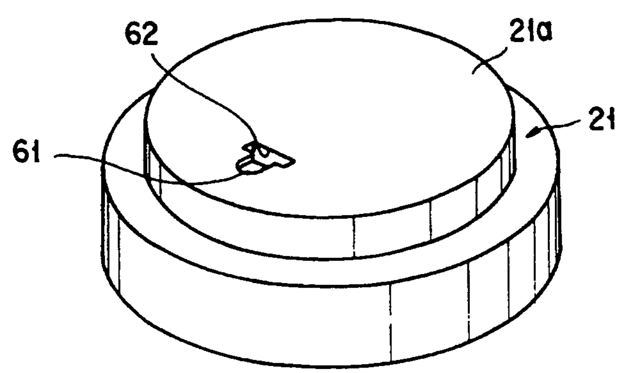

FIG. 3

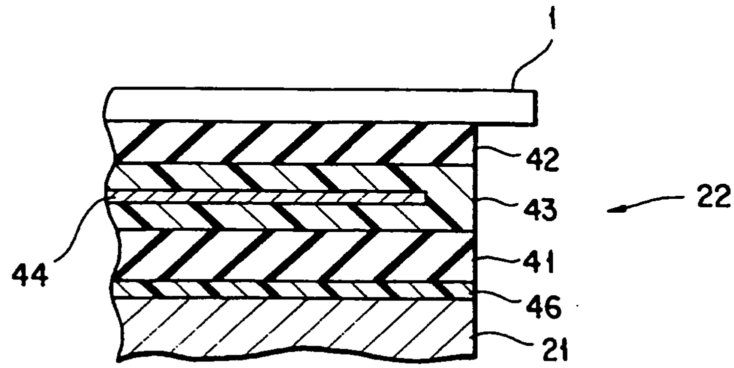

FIG. 4

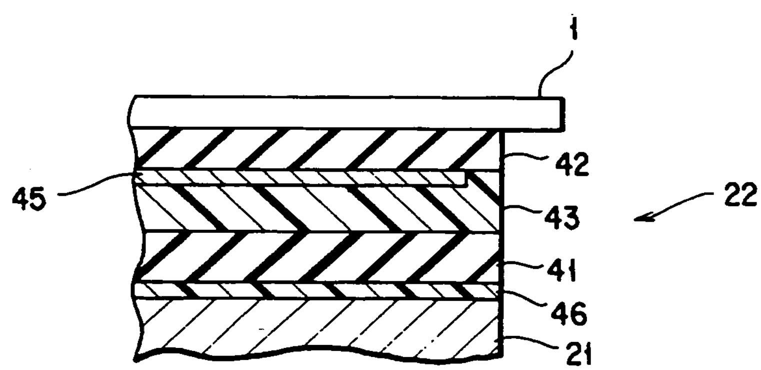

FIG. 5

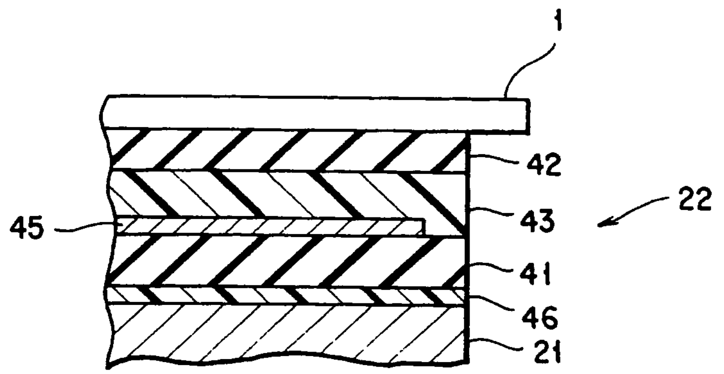

FIG. 6

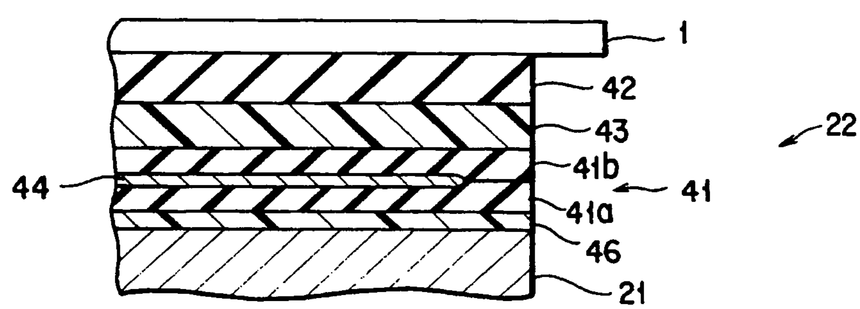

FIG. 7

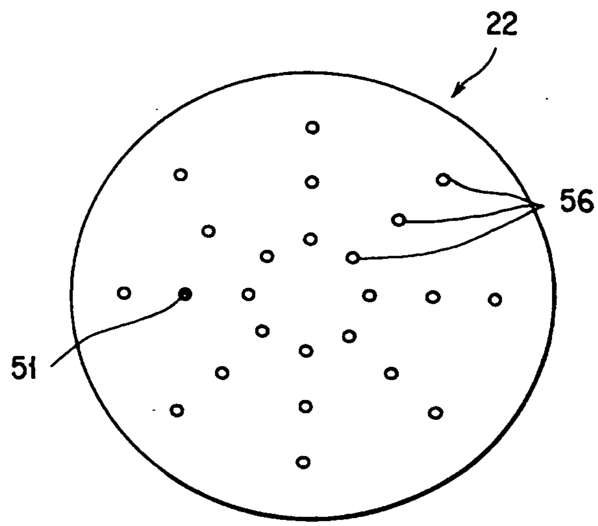

FIG. 8

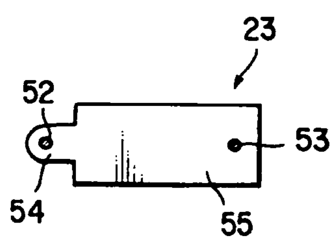

FIG. 9